

NOV 14 2006

Attorney Docket: N1085-00251[TSMC2003-0834]

REMARKS

Claims 1-22 are pending in the present application and each has been rejected. Claims 12, 16 and 18 are amended as set forth above. Reconsideration of this application and allowance of each of pending claims 1-22 are respectfully requested.

Amendments of Claims 12, 16 and 18

Claim 12 has been amended to replace the phrase "feed back" with the term "feedback" in response to the Examiner's request. Withdrawal of the claim objection is respectfully requested.

Claims 16 and 18 have amended to correct grammatical errors.

Claim Rejections under 35 U.S.C. § 102(b)

The Action rejects Claims 1-4, and 9-11 under 35 U.S.C. § 102(b), contending that the claims are anticipated by U.S. Patent No. 5,409,538 to Nakayama et al. ("Nakayama").

Claim 1 recites "controlling the exposure energy with a feedback process control signal of critical dimension, and further controlling the exposure energy with a feed forward process control signal of a compensation amount that compensates for wafer thickness variations." Applicants respectfully submit that Nakayama fails to teach or suggest the claimed features recited in independent Claim 1. Claims 2-4 and 9-11 depend from claim 1.

Nakayama is directed to a method of irradiating a substrate with light to measure variations in **optical properties**, such as reflectivity, refractive index, transmittance, polarization and spectral transmittance, for determining a photolithographic process. (see Abstract). Nothing in the description or drawings of Nakayama shows controlling an exposure energy with a feedback process control signal of critical dimension (CI) and controlling the exposure energy with a feed forward process control signal of a compensation amount that compensates for wafer thickness variations such as used to control exposure energy when patterning a substrate.

Appl. No. 10/783,495

Reply to Final Office Action of August 23, 2006

With respect to Nakayama, the Action refers to the data transferred from optical property measuring system 56 through interface 101 to process controlling system 45 as the feedback process control signal of critical dimension. (Col. 15, Lines 12-21). Applicants respectfully disagree with such characterization. In Nakayama, optical property measuring system 56 collects optical properties of an unpatterned photoresist layer. Optical properties generally include reflectivity, refractive index, transmittance, polarization, and spectral transmittance, and are collected from plain surfaces of material layers. In other words, the material layers should not be patterned. Unlike optical properties, a signal of *critical dimension*, such as a width or length of a pattern and as recited in Claim 1, is generated based on data collected from a patterned photoresist layer. Applicants respectfully submit that one of ordinary skill in the art of semiconductor manufacturing knows that "critical dimensions", CDs, refers to "dimensions of the smallest geometrical features (width of interconnect line, contacts, trenches, etc.) which can be formed during semiconductor device/circuit manufacturing using given technology" as defined in <http://www.semiconductorglossary.com/default.asp?searchterm=critical+dimension%2C+CD> as visited on 18 October 2006. Nakayama therefore does not teach this "feedback process control signal of critical dimension" feature. Since critical dimension and optical properties are so different in characteristics and ways of collection, Nakayama fails to teach or suggest the feature of the feedback process control signal of critical dimension. Claim 1 is therefore distinguished from Nakayama.

The Action also apparently refers to the data transferred from optical measuring system 108 through interface 103 to process controlling system 45 (FIG. 18) as the feed forward process signal feature of claim 1. Optical measuring system 108 collects optical properties of a wafer which is uncoated with a photoresist layer. (Col. 15, Lines 1-2) However, the feed forward signal recited in Claim 1 is used to control the exposure energy. Nakayama, not directed to exposure energy, does not provide a signal from optical monitoring system 108, that controls exposure energy. As such, Nakayama fails to teach or suggest the feature of the feed forward process signal of Claim 1. Claim 1 is therefore further distinguished from Nakayama.

Appl. No. 10/783,495
Reply to Final Office Action of August 23, 2006

Accordingly, Applicants submit that Claim 1 is not anticipated by Nakayama and is therefore allowable for at least the reasons set forth above.

Claim 2-4 and 9-11 depend from Claim 1 and are also allowable for at least reasons set forth above in connection with Claim 1.

Based on the foregoing, reconsideration and withdrawal of the §102(b) rejections are respectfully requested.

Further, since the optical properties of layers are clearly distinguished from critical dimension and thickness variation, one of ordinary skill in the art would not have been motivated to attempt to modify Nakayama's method to achieve the features recited in Claim 1.

Claim Rejections under 35 U.S.C. § 103(a)

The Action also rejects Claims 5-8 and 12-22 under 35 U.S.C. §103(a), contending that the claims were unpatentable over Nakayama in view of U.S. Patent No. 6,798,529 to Saka et al. ("Saka").

Claims 5-8 depend from Claim 1. As set forth above in connection with Claim 1, Claim 1 is distinguished from Nakayama because Nakayama fails to teach or suggest the claimed features of the feedback process control signal of critical dimension, and the feed forward process control signal. Further, since critical dimension and wafer thickness variations recited in Claim 1 are distinguished from optical properties described in Nakayama, it would not be possible for one of ordinary skill in the art to modify Nakayama in view of Saka to achieve the claimed features recited in Claim 1. Saka was apparently relied upon for tracking interlayer thickness measurement after chemical mechanical planarization. Even if one did combine the references, the result would still lack the differences between Claim 1 and Nakayama as pointed out above. Accordingly, Claim 5-8 are not obvious over the art of record and are therefore allowable for at least the reasons set forth above in connection with Claim 1.

Independent claim 12 recites that a feed forward controller providing a feed forward control signal to an exposure apparatus based on a thickness measurement of an interlayer of

Appl. No. 10/783,495
Reply to Final Office Action of August 23, 2006

the wafer substrate for controlling the exposure energy focused on a top layer of the wafer substrate, and a feedback controller providing a feedback exposure energy control signal to the exposure apparatus based on critical dimension measurement of a top layer of a wafer substrate of a previous manufacturing lot.

As conceded by the Action, Nakayama fails to teach a criteria dimension measurement of a top layer of a wafer substrate. In addition, as the reasons argued above in connection with Claim 1, the list of optical properties described in Nakayama does not include any critical dimension measurement, much less a critical dimension measurement of a top layer of a wafer substrate of a previous manufacturing lot. Claim 12 is therefore distinguished from Nakayama, and for reasons set forth above, one of ordinary skill in the art would not have been motivated in view of Saka to modify Nakayama to achieve the claimed features recited in Claim 12. Moreover, even if one did combine the references, the result would still lack the differences of Nakayama as pointed out above. It is submitted that Claim 12 is not obvious over the art of record and is therefore allowable for at least reasons set forth above.

Claims 13-22 depend from Claim 12 and are also allowable for at least the reasons set forth above in connection with Claim 12.

Reconsideration and withdrawal of the §103(a) rejections are respectfully requested.

Appl. No. 10/783,495
Reply to Final Office Action of August 23, 2006

Conclusion

In view of the foregoing amendments and remarks, Applicants submit that this application is in condition for allowance. Early notification to that effect is respectfully requested.

The Commissioner for Patents is hereby authorized to charge any fees required to give this filing effect or credit any excess payment that may be associated with this communication to deposit account 04-1679.

Respectfully submitted,

Dated: 14 Nov 2006



Mark J. Marcelli, Reg. No. 36,593
Attorney for Applicant

DUANE MORRIS LLP
101 West Broadway, Suite 900
San Diego, CA 92101
Telephone: (619) 744-2200
Facsimile: (619) 744-2201